THE ACTION OF TERAHERTZ LASER IRRADIATION ON DIATOM FRUSTULES

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The main feature of diatoms is the presence of a silica exoskeleton and a lot of biochemical and molecular biology studies are focused on the elucidation of the biosilica synthesis mechanism. A diatom cell uses a special organelle SDV (Silica Deposition Vesicle) to obtain elements of new diatom frustules. This organelle is relatively large, visible in light microscopy but there are no reliable data concerning the structure of its membrane and its contents. The silica exoskeleton is the main obstacle in a soft destruction of diatom cells and the isolation of non-destructed SDVs. Silica frustules are highly resistant to mechanical and chemical actions, so searching for new approaches in order to remove silica frustules from the diatom cells is an actual task.

Laser ablation using a free electron laser (FEL) is a novel method for soft destruction of supramolecular systems stabilized by hydrogen bonds [A. K. Petrov et al. Nucl. Instrum. Methods Phys. Res., Sect. A. 575:68]. The advantage of ablation with FEL consists in correspondence between laser frequencies (40-80 cm^{-1}) and vibrations of hydrogen bonds, and so the destruction of covalent bonds is unlikely. The softness of the ablation technique has been confirmed by the retention of enzymatic activity of horseradish peroxidase and PCR-proven integrity of lambda phage DNA, plasmid pUC18DNA after all manipulations.

We have found that the action of terahertz laser irradiation on the fresh-water diatom *Synedra acus* subsp. *radians* (Kützing) Skabichevskii results in the splitting of diatom frustules. The most effective was an irradiation of a wave length of 100 µm which is close to the diatom length. It seems as silica valves are torn away from the cell membrane and the whole cell contents remains in a non-destructed inner membrane. Chloroplasts and SDVs do not change their shape after the valve removing.

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